Claims

I claim:

1. A method of optimizing the metabolic control regimen of an individual and generating ongoing metabolic state predictions for improved decision support in said metabolic control, comprising the following steps:

(a) entering into an apparatus ongoing metabolite contemporaneous time-stamped inputs from a user-patient and from biomedical assay equipment according to an interactive, time-stamped mode;

(b) allowing said user-patient to accept or reject the contemporaneous time-stamped inputs and storing the accepted inputs in appropriate memory areas of said apparatus;

(c) selecting one or more biological analytes (metabolite output values) to be controlled proactively using metabolic state predictions;

(d) assigning to each said metabolite contemporaneous time-stamped input an appropriate time function that describes its dynamic characteristics;

(e) computing predicted values of each contemporaneous time-stamped input in an ongoing manner, starting from the time of the appropriate time stamp data;

(f) assigning to each predicted value a time function/mathematical model, said time function/mathematical model being described by a time function/mathematical model comprising the general formula of:

$$EG(t) = a^N t^{N-1} e^{-at} / (N-1)!$$

wherein:

EG(t) is an elementary food component glucose activity time function;

t is an elapsed length of time measured from the time stamp of entered data;

a is the flux rate of elementary food categories; and

N is the number of compartments;

(g) generating specific time functions comprising the general formula of:

$$PE(t) = c^N t^{N-1} e^{-c\,(t-d)} / (N - 1)!$$

wherein PE(t) is a physical exercise time function;

c takes a specific value for a type of exercise;

d is a delay factor;

t is an elapsed length of time measured from the time stamp of entered data; and

N is the number of compartments;

(h) improving the accuracy and precision of said mathematical model by making it an individual-specific mathematical model, by inputting user-patient anthropometrical characteristics into the time function/mathematical models;

(i) generating ongoing metabolic status predictions by combining all previous metabolite input predictions with the said individual-specific time function/mathematical model;

(j) improving the accuracy of the said individual-specific mathematical model in a recursive manner, until the said ongoing metabolic status predictions are sufficiently close to the actual measured values, said improved individual-specific model being referred to as an optimized metabolic model;

(k) contemporaneously computing usable ongoing metabolic status predictions from the optimized metabolic model and from the said input predictions in order to provide the patient with the necessary decision support information;

(l) recording and revising individual-specific medication and metabolic control parameter limits, wherein a health practitioner sets boundaries on the type of actions the patient can take and the information is stored in the said apparatus; and

(m) communicating to the patient the need for proactive corrective action, wherein any such need is determined by considering steps (k) and (j),

wherein said method is used optimizing the metabolic control regimen of astronauts during space flights or for optimizing the metabolic control regimen of people with special glucose metabolism needs, including but not limited to patients under intensive care, patients who have suffered trauma, premature babies, or people involved in performance sports.

2. The method of claim 1, wherein the contemporaneous time-stamped inputs are selected and specified in light of their predominant impact on the output value.

3. The method of claim 2, wherein the selection is made from nutrients, medication, physical activity, illness, or hormonal challenges.

4. The method of claim 1, wherein the metabolite output values are stored in said apparatus and are patient information.

5. The method of claim 3, wherein the nutrient is food and the metabolite is "exogenous glucose" from the food.

6. The method according to claim 1, further comprising refining said physical exercise time functions by accounting for the differences in lactate bio-availability experienced by the patient depending on the type or intensity of exercise performed.

7. The method according to claim 1, further comprising accounting for the additive or subtractive effect of illness, medication, or hormonal challenges by correcting the physical exercise input information accordingly.

8. The method according to claim 1, whereby contemporaneous decision support in metabolic control is achieved for obesity and weight control.

9. The method of claim 1, whereby contemporaneous decision support in metabolic control is achieved for diabetes.

10. The method of claim 9, wherein one metabolite contemporaneous time-stamped input is exogenous insulin following an injection or infusion pump action, and said input is:

(a) generating exogenous insulin time functions using the formula:

$$I(t) = b^N t^{N-1} e^{-bt} / (N - 1)!$$

wherein:

I(t) is an exogenous insulin time function;

b is the flux rate of various insulin types;

t is an elapsed length of time measured from the time stamp of entered data; and

N is the number of compartments;

(b) refining said exogenous insulin time functions by accounting for the differences in insulin bio-availability experienced by the patient depending on the injection site; and

(c) refining said exogenous insulin time functions by accounting for the differences in insulin bio-availability experienced by the patient depending on the patient's degree of insulin resistance.